

Amendments to the Specification:

Please replace paragraph number [0001] with the following rewritten paragraph:

[0001] Cross-Reference to Related Application: This application is a continuation of application Serial No. 08/906,578, filed August 5, 1997, now U.S. Patent 6,336,973, issued January 8, 2002.

Please replace paragraph number [0006] with the following rewritten paragraph:

[0006] Furthermore, and of even greater potential consequence than bond pad or street interference is the effect that the lateral flow or spread of adhesive material 310 has on the adhesive material upper surface 316. As shown in FIG. 27, the adhesive material upper surface 316 is the contact area for lead fingers 318 of a lead frame 320. The gravity-induced flow of the adhesive material 310 causes the once relatively-well-defined well-defined edges 322 of the adhesive material to curve, resulting in a loss of surface area 324 (ideal shape shown in shadow) for the lead fingers 318 to attach to. This loss of surface area 324 is particularly problematical for the adhesive material upper surface 316 at the longitudinal ends 326 thereof. At the adhesive material longitudinal ends 326, the adhesive material flows in three directions (to both sides as well as longitudinally), causing a severe curvature 328, as shown in FIGs. 28 and 29. The longitudinal ends of the adhesive print on patch flow in a 180° flow front, resulting in blurring of the print boundaries into a curved perimeter. This curvature 328 results in complete or near complete loss of effective surface area on the adhesive material upper surface 316 for adhering the outermost lead finger closest to the adhesive material longitudinal end 326 (lead finger 330). This results in what is known as a “dangling-lead.lead.” Since the lead finger 330 is not adequately attached to the adhesive material longitudinal end 326, the lead finger 330 will move or bounce when a wirebonding apparatus (not shown) attempts to attach a bond wire (not shown) between the lead finger 330 and its respective bond pad 304 (shown from the side in FIG. 29). This movement can cause inadequate bonding or non-bonding between the bond wire and the lead finger 330, resulting in the failure of the component due to a defective electrical connection.

Please replace paragraph number [0010] with the following rewritten paragraph:

[0010] The present invention relates to a method for applying an adhesive material to lead fingers of a lead frame wherein surfaces of the lead fingers which receive the adhesive material face downward to contact a pool of adhesive material. Preferably, the adhesive material cures with the lead frame in this downward facing position. The advantages of placing viscous material, such as an adhesive material, in a downward facing position is described in U.S. Patent Application Serial Number-08/709,182 08/709,182, by Tongbi Jiang and Syed S.Ahmad Ahmad, filed September 6, 1996, assigned to the assignee of the present invention and hereby incorporated herein by reference. An adhesive reservoir retaining the adhesive material can be shaped such that the exposed surface (pool) of the adhesive material is in a precise location. When the lead fingers contact the exposed surface of the adhesive material, the adhesive material attaches to only specific, desired portions of the lead fingers.

Please replace paragraph number [0040] with the following rewritten paragraph:

[0040] As shown in FIG. 6, the lead fingers 104 are lowered onto or proximate the exposed surface 122 of the adhesive material 114. When a bottom surface 124 of the lead fingers 104 comes in contact with the exposed surface 122 of the adhesive material 114, the adhesive material 114 wets out across the bottom surface 124 of the lead-finger fingers 104. As shown in FIG. 7, when the lead fingers 104 are retracted from the adhesive material 114, the cohesion of the adhesive material 114 with the lead fingers 104 pulls some of the adhesive material 114 from the bulk of the adhesive material 114 to form an adhesive film 126 on the bottom surface 124 of the lead-finger fingers 104. The thickness of the adhesive film 126 can range from 0.1 to 15 mils, depending on the viscosity of the adhesive material 114. Changing the shape of the lead-finger fingers 104, changing the rheology of the adhesive material 114, pre-coating the lead-finger fingers 104 with a surfactant, such as AMP, or placing a solvent in the adhesive material 114 to improve wetting, and/or adding adhesion promoters, such as silane, siloxane, or polyimide siloxane, to the adhesive material 114 will also change the thickness and/or pattern of the adhesive film 126. It is, of course, understood that the adhesive

material 114 must be capable of adhering to the lead fingers 104 and must not be of such a low viscosity that it drips when the lead fingers 104 are removed from contact with the exposed surface 122 of the adhesive material 114.

Please replace paragraph number [0041] with the following rewritten paragraph:

[0041] FIG. 8 is a side cross-sectional view of a lead finger 104 after adhesive material 114 application. FIG. 9 is a cross-sectional view of the lead finger 104 of FIG. 8 along line 9-9. As shown in FIGs. 8 and 9, by only contacting the bottom surface 124 of the lead finger 104 with the exposed surface 122 of the adhesive material 114 (see FIG. 6), the adhesive material 114 will not wet sides 128 of the lead finger 104 and, of course, will not collect on a bond wire surface 130 of a lead finger 104 (the bond wire surface 130 is the lead finger surface where a bond wire is subsequently attached during further processing). Since the adhesive material 114 does not collect on the bond wire surface 130, there will be no adhesive material 114 to interfere with a subsequent wirebonding step subsequent to LOC attachment of the lead fingers 104 to an active surface of a semiconductor die.

Please replace paragraph number [0048] with the following rewritten paragraph:

[0048] A preferred method of controlling the levelness of the exposed surface 122 is by forcing or extruding the adhesive material 114 through a coating stencil having small apertures, such as a screen or a plate with slots. Such a coating stencil 150 is shown in FIG. 13. The coating stencil 150 is a flat plate 152 having a plurality of slots 154. The coating stencil 150 shown has twenty-three parallel slots 154 approximately 0.260-inches inch in length 158 and approximately 0.010-inches inch in width 160, with the slots 154 being on parallel centerline pitch 162 of approximately 0.020 inch from one another. An alternate coating stencil 156 is shown in FIG. 14. The coating stencil 156 is a screen comprising a flat plate 157 having a plurality of square or rectangular apertures 159. It is, of course, understood that the apertures may be of any size (depending on the viscosity of the adhesive material) and any shape, including triangles, rectangles, squares, circles, ovals, or the like.

Please replace paragraph number [0051] with the following rewritten paragraph:

[0051] An example of the difference between a non-stenciled adhesive material exposed surface 172 and stenciled adhesive material exposed surface 174 is shown in FIG. 17. For this example, the adhesive material 114 was Ablestik XR-041395-9™ Polyimide LOC Adhesive (Ablestik (Ablestik Laboratories, Rancho Dominguez, CA) and the coating stencil 150 was as described above for FIG. 13. Ablestik XR-041395-9™ has a viscosity of 62,000 cps at 25°C and a thixotropic index of 3.5. It is, of course, understood that the width, length, pitch and shape of the apertures in the coating stencil will vary for different viscosities of adhesive materials. A rule of thumb for determination of aperture size is that, for every viscosity increase of 25%, the aperture size should decrease by 50%.

Please replace paragraph number [0052] with the following rewritten paragraph:

[0052] The illustration in FIG. 17 is an AutoCad™ program rendering of a digitized measurement of the non-stenciled adhesive material exposed surface 172 and stenciled adhesive material exposed surface 174. The maximum height 176 of the non-stenciled adhesive material exposed surface 172 was approximately 0.07-inches inch above an upper surface 175 of the coating stencil 150 and the effective adhesion surface 178 of the non-stenciled adhesive material exposed surface 172 was approximately 0.26-inches inch wide. The maximum height 181 of the stenciled adhesive material exposed surface 174 was approximately 0.05-inches inch and the effective adhesion surface 182 of the stenciled adhesive material exposed surface 174 was approximately 0.33-inches inch wide. Thus, the use of a coating stencil 150 resulted in an increase of effective adhesion surface of about 21.2%. The effective adhesion surfaces 178, 182 are determined as the area from the maximum height 176, 181 of the stenciled non-stenciled adhesive material exposed surface 172, 172 and stenciled adhesive material exposed surface 174, to a position about 5 mils below the maximum height 176, 181.

Please replace paragraph number [0054] with the following rewritten paragraph:

[0054] An example of one preferred embodiment of the coating process is illustrated in FIGs. 19-21. Elements common to FIGs. 19-21 and previous FIGs. retain the same designations. As shown in FIG. 19, the lead fingers 104 are brought into close proximity to the adhesive material exposed surface 122. Sufficient adhesive material 114 is then delivered to the adhesive reservoir 110 until the adhesive material exposed surface 122 comes in contact with the bottom surface 124 of the lead fingers 104. At this point, additional adhesive material 114 is delivered to the adhesive reservoir 110 to raise the adhesive material exposed surface 122 about an additional 0.02 to 0.06 inches inch so that the lead fingers 104 are submerged past a top surface 184 of the adhesive material exposed surface 122, as shown in FIG. 20. The lead fingers 104 remain in this position for a time sufficient to allow the adhesive material 114 to wet the bottom surface 124 of the lead fingers 104, preferably approximately 10 to 25 milliseconds. As shown in FIG. 21, the adhesive material exposed surface 122 is then lowered, thereby forming the adhesive film 126 from the bulk of the adhesive material 114 on the bottom surface 124 of the lead-finger fingers 104. The lead frame ribbon 100 is then indexed to the next site that requires coating. Before the adhesive material 114 is raised again, more adhesive material 114 is delivered, as required, to replenish the amount used in the previous coating cycle.